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ABSTRACT

An increasing awareness of environmental issues and the implementation of environmental programs internationally has spurred a greater need for environmental education and training in many countries. This document is the first in a series of papers that will examine and provide insights into available national training programs for environmental protection. The analyses here highlight the weaknesses and insufficiencies, as well as the effectiveness and innovations, found within both the formal and the informal training programs in the Lombardy and Umbria regions of Italy. Following a historical background introduction, the contents are: (1) the knowledge and skills for environmental protection formally developed within local schools; (2) university courses currently offered in environmental protection; (3) environmental protection profiles and the employment market; (4) the gap between knowledge and skills needed for environmental protection and the limitations of school dropouts and university graduates; (5) specific problems related to training for environmental protection; (6) vocational training courses in environmental protection for the researcher, the professional, and the technician; (7) training for environmental protection addressed to the general public; (8) conclusions and propositions for future analysis; and (9) appendices which contain detailed descriptions of courses in environmental protection from a typical vocational school and a typical workshop on environmental impact assessment, the listing of consultants who provided input for this document, and a list of 25 bibliographic entries. (JJK)

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Training for environmental protection in the Lombardy and Umbria regions

by Raul Gagliardi

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Training Policies Branch
INTERNATIONAL LABOUR OFFICE GENEVA

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Summary

An increasing awareness of environmental issues and the implementation of environmental programmes internationally has spurred a greater need for environmental training in many countries. In recent years, this segment of the training sector has developed rapidly. F/POL's environmental training project has the objective of documenting and evaluating innovative environmental training programmes in selected countries.

This paper examines training programmes in environmental protection in the Lombardy and Umbria Regions of Italy. The analysis points out the insufficiencies of the Italian educational system which have led to the development of a formal and non-formal training market for environmental protection. It suggests some of the weaknesses and "gaps" which result from this system, as well as some of the more effective and innovative aspects of the programmes. Finally, it identifies a number of programmes suitable for further analysis, which will be evaluated in a forthcoming Training Policies Discussion Paper.

This paper is the first in a series of country papers that will aim to provide insights into currently available training programmes for environmental protection. The author of the paper is Dr. Raul Gagliardi, a biologist by training, who has extensive experience in designing and managing environmental education and training programmes. The paper was edited by Ms. Pam Zachar.

Introduction

In the streets of Milan, some people use masks to protect themselves against atmospheric pollution. It is difficult to say whether these masks are effective; probably not, because they filter only the relatively large particles and they do not eliminate molecules of gas pollutants. However, these masks are symbolic of the population's growing concern about the negative transformation of the environment.

The quality of life in Italy, as in other countries, is increasingly degraded by noise, air, water and soil pollutants, and by the disappearance of plant and animal species. These environmental changes, which have been caused mainly by human activities, can lead to serious health problems.

Consequently, in Italy there has been a growing consciousness surrounding environmental issues. There has been a change in attitude from an "emergency situation" - in which urgent action was organised to stop ecological disasters - towards a new "culture of environmental protection" in which the prevention of negative environmental impacts is part of fundamental changes in current activities - such as car driving - that have a negative impact on the environment.

In discussions with Italian experts in environmental protection, an opinion was frequently expressed that Italy lags behind other European countries in environmental protection. However, Italian concern for the environment is not a recent phenomenon. Italian laws for environmental protection date as far back as 1895 (Norms Law for beaches and lakes). In 1904, regulations were approved which prohibited the construction of fishing installations that change the natural flow of water and other activities that can change the structure of river basins (such as plantations, etc.).

Since 1986, Italy has had a Ministry of Environment, responsible for the promotion of environmental protection. The fundamental activities in environmental protection, however, are organised at a regional level. The Regions are responsible for environmental policing functions and other activities for environmental protection, including the monitoring of air, water, and soil pollutants, the organisation of waste treatment, the control of drinking water, etc. The Regions also collaborate with the central government in environmental education and in training for environmental protection.

The results of these efforts in training and education, on both the Regional and Central level, are what this study seeks to determine. Activities in the Italian Regions of Lombardy and Umbria were analysed searching for examples of the most important problems and the better solutions in training for environmental protection. The goal was to provide a panorama of the most significant experiences in this area. This was achieved, whenever possible, through personal discussions with those responsible for training, and often with teachers and students themselves.

Members of 26 institutions of the Lombardy and Umbria regions were interviewed. Although the regions differ, there are no significant differences in their approaches to training for environmental protection. For this reason, the tendencies and the most significant examples of both regions were analysed together.

The organisation of this report is as follows:

Knowledge and skills for environmental protection developed at school;

University courses for environmental protection;

The professional profile and the employment market characteristics for environmental protection;

The gap between the knowledge and the skills needed for environmental protection and the capacity of school leavers and university graduates;

Specific problems for training in environmental protection;

Examples of training activities in environmental protection for researchers, professionals and technicians;

Examples of training activities in environmental protection for the population;

Propositions for future analysis;

Conclusions.

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I. The knowledge and skills for environmental protection developed at school

The public educational system in Italy is organised centrally, dependant on the Ministry of Education. Curricula are decided on by the Ministry, which also determines the activities for the in-service training of teachers. These activities are then organised and executed at a regional level by Regional Institutes for Research and Teachers' Training (Instituto Regionale di Ricerca, Spermentazione e Aggiornamento Educativi: IRRSAE).

In 1985, the Regional Institute of Lombardy (IRRSAE Lombardia) began to organise environmental education seminars for secondary school and high school teachers. The goal of these seminars was to train them in the use of new teaching methods and materials and new contents for courses in environmental education. The seminars were organised according to a system of "research-action", in which the teacher concurrently teaches and performs research on efficacy and methods of teaching. In the course of this research, the author had the opportunity to organise and direct some of these seminars. Teams of secondary and high school teachers were organised to analyze environmental education issues according to three axes:

The characteristics of the students: their ideas, knowledge, beliefs, logical capacity, ability to deal with complex systems;

Basic content of different disciplines and the best teaching strategies for them;

The "multidisciplinary approach," in which the teaching of human sciences , physical, chemical, and biological sciences are coordinated around the teaching of some basic aspect of environmental education.

The activities of these teams led to a number of conclusions about teaching methods for environmental protection. One was the understanding that the teaching of environmental education should not be limited to science courses (in particular, ecology). The only way to obtain a complete understanding of environmental problems is to integrate ecological subjects with "social science" subjects such as history, geography, and economics. Furthermore, the results indicate that this multidisciplinary approach can be organised around the study of a particular region, including all of its historical, economical, geographical, political, and ecological aspects.

Another result of the "research-action" seminars was an increased understanding of the advantages of the methodology proposed by the Laboratory of Didactics and Epistemology of Sciences at the University of Geneva and other university research centres. This methodology requires an initial analysis of students' conceptions about the environment and related matters. By "conception" we mean the ideas, knowledge, and beliefs about a matter that are used in the understanding of the observed phenomena and in the building of new knowledge. It is then possible to define the basic concepts necessary to permit the students to surmount the obstacles revealed by the analysis of their conceptions.

The use of this methodology can and has been used in the analysis of a representative sample of intermediate and senior high school pupils. The results are useful not only for the improvement of environmental education in secondary and high schools, but also for training in environmental protection at all levels. Studies performed using this methodology show that in Italy:

Students do not have the basic knowledge necessary for learning ecology and, in general, environmental subjects. They do not have correct scientific knowledge about energy, the structure of matter, the characteristics of living organisms, the ecosystems' structure and dynamics, the transfer of energy and matters, the relationships between human activities and processes in ecosystems, etc. These subjects are studied in intermediate and senior Italian secondary schools and they should be part of the students' general knowledge. Similar results have been obtained in other European countries (France, Spain and Switzerland);

Students do not understand complex systems or relationships, such as ecosystems or human societies. Their answers usually demonstrated a linear thinking process. They were unable to present "networks" of processes organised in a complex causality;

Students show an "anthropocentric" approach to the environment. They are mostly preoccupied with themselves as human beings. They regard ecosystems only as a source for the gratification of their human needs;

Students have a limited understanding of the causes and contributors to environmental degradation. They think that the most important cause of pollution is domestic waste and they lack a clear perception of the process of transformation of waste in ecosystems. Recycling is the solution to every problem.

These results indicate that before starting a training activity for environmental protection it is important to analyze the capacity of the students to deal with complex systems and to evaluate their basic knowledge about the sciences related to environmental protection.

The completion of secondary schooling by training participants is not a guarantee of their capacity and their knowledge to understand environmental protection subjects. Therefore, either a strengthening of these subjects in secondary schools or an inclusion of these concepts in a training programme is necessary if effective environmental training is to occur.

II. University courses in environmental protection

After discussion with teachers and researchers in biology and ecology from the universities of Milan, Turin and Pavia, and as a result of experience as a visiting professor in two of these universities, it is clear that Italian Universities do not yet provide complete training in environmental protection.

Each of the different professions linked with the environment (engineering, ecology, architecture, etc.) has developed its own approach to environmental problems which corresponds to the particularities of its professional activities. To avoid such a narrow focus, training courses should be designed to cover the entire scope of economic, social and ecological elements of the environment. Until now, environmental training has been limited to ecology and other related environmental matters, which in turn have been only one aspect of studies in biology or the natural sciences.

Unfortunately, Italian unitversities do not yet offer multidisciplinary programmes that cover complex systems composed of societal, physical, geological, chemical, atmospheric and ecological elements. A programme such as "expert in environmental management" might be one example of such a multidisciplinary degree programme.

However, at a meeting of the Italian Society for Ecology, it was stated that some Italian Universities will start to organise training for environmental protection as a specific professional field of study. The Universities of Bologna, Milan, Naples, Pavia and Venice will organise a new "Laurea" (five years of study, equivalent to a Masters) in "Environmental Sciences" and in "Territorial Sciences". The graduates ("Laureati") are expected to work in environmentally-related activities.

Some universities are starting to organise shorter studies (three years) for "environmental technicians". The University of Pavia had planned a course for environmental technicians that was not accepted by the authorities. Furthermore, the University of Bari is starting to organise courses for technicians in the marine environment and also in fish marketing.

Italian universities also organise postgraduate courses in environmental protection, such as the courses of the Milan Polytechnics. These courses can fill the gap between what the universities offer and the necessary professional profiles for current activities in environmental protection.

Other activities are undertaken by university teachers and researchers who collaborate in developing programmes for school teachers' training in environmental education. Some of the university staff also participate directly in environmental education activities such as conferences, seminars, etc., addressed to the general public.

III. Environmental protection profiles and the employment market

One of the problems in environmental protection training in Italy is the rapid transformation of the employment market. New professional profiles and changes in existing professions are elements that must be taken into account in the analysis of training for environmental protection.

Relationships between human activities and ecosystems are becoming more and more complex. As a result, the necessary activities for environmental protection are changing. The capacity to understand complex systems, with networks of cause/effect processes, is fundamental to the prevention of the undesirable effects of human activities.

An example of this increased complexity is the issue of controlling environmental processes - in particular, the measure of chemical pollutants - which has become a large challenge to public and private enterprises. The chemical analysis of the environment, traditionally performed by experts trained in scientific fields, is now done by electronic devices that continuously measure the air, water, and soil with an accuracy a thousand times higher. These computer systems are able to handle continuous analysis of an enormous quantity of data. The new professional who monitors the environment must therefore know not only chemistry and biology, but also data base organisation and environmental sciences.

For example, in some of the training activities for environmental protection in the Lombardy and Umbria regions, students are trained in the analysis of data collected by satellites, the use of electronic monitoring devices that use solar energy, and the organisation of tourist activities compatible with environmental protection.

Training for environmental protection must respond to the related Italian employment market which is fragmented and in rapid transformation, in which the traditional professions evolve quickly and new professions continue to develop. To cope with constantly emerging environmental problems, a flexible in-service (on-or off-the-job) training system is essential.

An occupational analysis of professional profiles for environmental protection, undertaken by the "Istituto Regionale di Ricerche Economiche e Sociali" in the Umbria Region, exemplifies the complexity of professional needs. This analysis was focused on four activities: management of hydric resources, rubbish disposal, air pollution and forestry.

Forty professional profiles were chosen for examination. They represented professions that do not yet exist, but will probably be developed in the near future, or existing professions that need to acquire new professional content.

The analysis showed that most of the professional profiles in environmental protection are at an intermediate level, between the specialised technician and the manager. Therefore, a complementary training programme should be created which combines technical and managerial skills into a balanced professional programme.

IV. The gap between the knowledge and the skills needed for environmental protection and the capacity of school leavers and university graduates

The above-mentioned analysis shows the need for post-graduate training for both school leavers and university graduates. The in-school training system is insufficient for developing the technical aspects and multidisciplinary approach necessary for dealing with environmental problems.

Both the secondary school leavers and the university graduates surveyed agreed that although their education provided a foundation for professional activities, they did not have the necessary background to be able to work independently or to integrate easily into professional teams working in environmental protection.

This is the reason for the development of postgraduate training courses for environmental protection organised by institutions such as trade unions, private enterprises, Regions, Provinces and Communes. These courses try to "fill the gap" between the training needs for employment and the training provided by schools and universities.

In Italy, a formal and non formal training market is developing to complement the programmes provided by schools. There are "local" solutions to cope with this situation for example, taking the form of short or medium length courses. However, the gap between environmental protection news and the capacity of school leavers cannot be solved only by post-graduate courses. The conceptual tools and basic knowledge of environmental issues must be developed at the compulsory school level. If such a foundation for environmental training were introduced into the school system, the post-graduate courses could better serve their purpose of extending and specialising this knowledge for subsequent professional activity.

Furthermore, the diversity of institutions which provide training for environmental protection presents a problem to the students or school leavers. There is no easily accessible information about the different courses or about the possibilities for employment provided by the training. The student who is looking for a job related to environmental protection must decide between different training courses without the necessary information about the actual possibilities for employment. A labour market information system, which could match up prospective students with environmental training programmes that provide the skills to meet the demands of the employment market, could provide an essential service to both students and potential employers.

The growing needs for training in environmental protection require a number of fundamental changes in the Italian education system. Different teams of researchers, school teachers and members of associations for environmental protection are working together to improve the system of environmental education in schools. Flexibility and adaptability should be the key characteristics of the young peoples' backgrounds if they want to adapt to a changing employment market. Furthermore, a data base information service would provide an invaluable link between employers' demand for environmental skills and the supply of graduates with the requisite qualifications.

V. Specific problems related to training for environmental protection

The need for developing the capacity to deal with complex systems as one of the most important problems of training for environmental protection has been mentioned. There are also other characteristics of environmental protection that should be taken into consideration in the organisation of training.

One important problem related to environmental management is the difficulty encountered in coordinating activities for environmental protection of different graduate-professionals and technicians. Each group has its own approach to environmental problems and its own jargon, background, conceptual framework and methodology.

This problem is addressed in one of the postgraduate courses of Milan's Polytechnic (SILVA). The proposed solution is the utilisation of computer programmes as axes for the co-ordination of activities.

Another problem which was also mentioned above is the choice between two ways of organising the training: to introduce complementary knowledge and skills in existing professions or to organise new courses leading to new professions. Actually, these alternatives are complementary and can be developed in parallel. Environmental protection is a new science that has a "new theoretical corpus", new instruments and a new conceptual approach. However, existing professions must also be oriented towards environmental problems, in order to reduce the negative environmental impact of economic activities. The same materials may be introduced as part of the training for existing professions and as a basis for the newly created positions.

A third problem derives from the two different approaches to environmental protection: the analysis of the elements of the ecological system (for example the measure of chemical pollutants) versus the development of more general global models necessary to understand the interactions between the elements of the ecological system. For example, it is not sufficient to understand the processes of chemical pollution; without the broader view of how the chemicals affect different elements of the ecosystem, an understanding of the chemicals themselves is useless for environmental protection.

Both approaches should be integrated into training for environmental protection; it is not possible to prevent the negative impact on the environment without an understanding of the complex system of relations between the different components of the interrelated systems. And it is not possible to control environmental variables (chemical pollutants, temperature, population dynamics, etc.) without the capacity to measure them. The global description of environmental processes should be supported by the specific analysis of the different variables.

An analysis of the different courses on environmental protection indicates that these two approaches are not yet well integrated. Usually, some subjects deal with the systems (ecology, for example) and other subjects concentrate on the analysis of the variables. In most cases, there are different teachers for each approach. Since experience in the didactics of science and in the teaching of biology and ecology shows that students are unable to spontaneously integrate the analytical and the global approaches, it is obviously necessary to organise specific training activities which promote the integration of these approaches in students' minds.

This development of integrated knowledge and skills and the development of the capacity to understand global systems and specific processes is of fundamental importance and can provide a basis for the evaluation of courses in environmental protection.

Environmental protection includes not only concrete problems that can be analysed scientifically, but also moral, ethical, and political problems that should be discussed during training. Training for environmental protection should therefore not be limited to technical matters but should include the analysis of social and cultural systems and their interaction with the environment.

Activities for environmental protection induce ecological, economical, social, and cultural impacts. All of these elements must be analysed before the planning and implementing of environmental protection activities. This analysis shows that training for environmental protection in Italy must be restructured to cover all these problems, in order to maximise the impact of environmental protection.

VI. Training courses for environmental protection

As we have shown in sections two and three, Italian schools and universities do not organise courses for training in environmental protection for regular students. These training needs are met in the Lombardy and Umbria regions through activities organised by different public and private enterprises, such as trade unions, regional, provincial, and municipal institutions, universities (postgraduate courses), etc.

These training activities are addressed to university professionals, technicians and school leavers, and are oriented towards different kinds of environmental problems, such as chemical pollutants, water disposal, urban organisation, etc.

The analysis undertaken by the author indicates that these training activities are not well coordinated. There appears to be no global analysis of training needs and training resources in the Umbria and Lombardy regions. Discussion with the organisers of different training activities indicates they were organised in order to solve local problems and do not follow a central plan. This lack of coordination causes a dispersion of efforts by training institutions. Although there are several training courses for some environmental protection activities (such as sewage disposal and the measurement of chemical pollutants), there are not sufficient training courses for other environmental protection activities (such as the management of ecosystems). Without some type of information service, there is no way to avoid duplication or gaps between courses and no ability to profit from others' mistakes.

Another problem, already mentioned, caused by the lack of co-ordination of training activities for environmental protection is the difficulty in obtaining information about them. Prospective students have no means of finding out about existing courses and the employment possibilities they offer. In particular, they do not have information about the job opportunities which will result from following one of the training courses. The situation is frustrating. New activities for environmental protection will probably be developed in Italy in the coming years, which will create new jobs; however, many school leavers and unemployed youth will not opt for them, because they lack the necessary information about them or do not have the necessary background.

Fortunately, some institutions are planning and implementing training activities for environmental protection which take into consideration not only the training needs, the training resources, and the students' backgrounds, but also the important fact that the training may help in reducing unemployment.

Some information about the principal characteristics of some of the courses analysed for this report follows. Details about programmes, duration, fees, etc., are provided in Annex 1.

A. Training for researchers in environmental protection

Research in environmental protection requires the building of knowledge and the development of multi-disciplinary skills. Graduates in fields such as chemistry, biology, ecology, physics, pathology, or molecular biology must receive complementary training if they want to work as researchers in environmental protection. Accordingly, researchers in environmental protection are trained in postgraduate courses that complement their original background.

Training for research in environmental protection should develop the capacity to deal with

complex systems and, at the same time, develop highly specialised laboratory skills.

Good examples of such training are the activities organised by the Mario Negri Institute for Pharmacological Research in Milan. Here, university graduates in biology and pharmacology can follow an intensive training programme, working in the Institute's laboratories for three years, under the direction of the Institute's senior researchers. The goal of the training is to develop the capacity to work autonomously in laboratories of industries and public enterprises, doing such activities as measuring chemical pollutants and analysing their carcinogenic and genetic effects. The Institute also organises the training of laboratory assistants.

These training activities are organised in order to stimulate the development of specific research skills. The strategy is to give the student a research subject and incorporate him into one of the Institute's laboratories. The students are thus "immersed" in the laboratory's activities and can help to solve the laboratory's current problems. At the same time, they learn how to organise their research, analyse a bibliography, and develop other skills invaluable for future employment.

B. Short training courses for professionals

Engineering is one of the professions which must deal with environmental problems. The Milan Polytechnic meets this training need for engineers by organising short training courses which last about a week. The subjects covered pertain to different aspects of environmental protection, such as environmental impact assessment of engineering projects, analysis of costs and profits, the use of software for simulation of environmental impact, and solutions to the problem of water pollution.

The participants are professionals who work in environmental engineering, environmental impact assessment, and sanitary engineering. These short courses provide them with new approaches to problems they currently face in environmental protection.

Other short courses are available for professionals whose work activities pertain to environmental protection. For example, the Federation of Technical and Scientific Associations in Lombardy organises short training courses for scientific researchers and technicians. The duration of the courses is about a week.

One example is a series of courses in biological systems for sewage disposal, in which problems such as the management of the sewage disposal systems and the removal of nitrogen and phosphorus from sewage liquids are addressed. These courses are intended for professionals and technicians who work in sewage disposal installations.

These short courses usually provide training to apply computer programmes to environmental protection activities. In addition, the course matter often includes discussion of the implications of environmental legislation in planning and implementing economic activities.

C. Long training courses for technicians

Technicians who work in environmental protection need a long training course in order to develop the knowledge and skills necessary for their work. Most of the skill requirements are so specialised that they must be "tailored" to specific needs.

This was the approach adopted in the Lombardy and Umbria regions. Such training can also help solve unemployment problems. However, these programmes have the drawback of providing a background so specific that changing jobs can become difficult or impossible.

1. Long training courses for technicians organised by workers' associations

One of the biggest Italian workers associations, ACLI (Italian Christian Workers Association) has a dependant institution, En.A.I.P (ACLI Institution for Professional Instruction), charged with professional training. One of the goals of En.A.I.P. is to promote vocational training for unemployed youth.

En.A.I.P. Lombardy organised two courses related to the environmental impact of the tourism industry. These courses are good examples of new professional profiles in environmental protection.

One of the courses offered was orientated to tourism and environmental education. However, experience has shown that these subjects must be treated at length and that the resulting professional profile does not correspond to employment market needs.

The other course aimed to create a new professional profile: "environmental tourism agents", who would organise tourism activities compatible with environmental policy, such as agro-tourism.

In addition, En.A.I.P. Sondrio has organised "tailored" training courses for environmental protection directed towards territorial maintenance, for technicians in mountain territories and wardens in nature parks. These courses exemplify one of the most important problems in environmental training in underdeveloped regions: high cost, little demand. The training courses must be changed frequently because the employment opportunities for a particular professional profile are so small that the students of one course fill up existing job opportunities in that field of study.

One possible solution to this situation is through expansion of the employment market. Investment in environmental protection related activities that require new professional profiles can create new jobs, requiring new training courses.

Another solution would be the development of a basic training module which would form the foundation of an environmental training programme. This module could then be complemented by the addition of specialised, shorter courses, in order to fit the needs of various enterprises. Such a modular approach would alleviate the lack of job mobility resulting from early specialisation.

2. Long training courses for the prevention of ecological disasters

One aspect of environmental protection is the prevention of ecological and geological disasters. This requires continuous measurement of geological and ecological parameters, the management of territory, and the planning of economic activities in order to reduce their impact on ecological and geological systems.

The Valtellina region, north of Lombardy, was devastated in 1987 by a flood provoked by meteorological conditions and by the transformation of the territory caused by changes in agricultural activities.

A consortium of private enterprises, with the participation of the European Social Fund and the Lombardy region was organised to train technicians for disaster prevention. The consortium organised three courses:

Training for Territorial Data Gathering and Inputs Specialists, who will install and utilise instruments for the measure of environmental variables and will organise collection of data;

Training for Information System Managers, who will install and utilise the information systems;

Training for Territory Administrators, who will analyse the status of the territory using the ecological and geological data.

The Commune of Grosio (a small mountain commune) organised some long courses, with the help of the European Social Fund, for

training in environmental monitoring and energy conservation. One interesting aspect of these courses is that they provide trainees with managerial skills for environmental protection activities. For example, students learn how to organise the programmes, how to advertise and "sell" them (i.e., marketing skills) and how to make contracts, etc.

3. Training activities for environmental protection in the Umbria region

The Umbria region uses two strategies to solve the problem of training technicians for environmental protection:

The organisation of international training for 12 students who visit different European training centres for environmental protection.

The organisation of courses for a consortium of enterprises related to civil engineering and computing systems. These enterprises use highly sophisticated equipment and techniques for measuring environmental parameters and collect and analyse data with the help of computers. The students are trained in using the instruments and the computer systems of the enterprises.

These courses are noteworthy because they attempt to combine different disciplines in order to provide a complete background for new technical professions, such as in environmental monitoring. The goal was for the students to develop a "framework of skills" necessary to deal with the complexity of the environment. This goal was obtained by the training approaches used and by the participation of teachers from several different professions.

VII. Training for environmental protection addressed to the general public

Environmental protection should not be limited to specialists. For example, environmental education can also be addressed to the population as an added mechanism for controlling the environmental impact of economic and social activities. One such public training programme is the Corps of Voluntary Ecological Wardens, charged with environmental policing in Regional Natural Parks, Regional Reserves and Protected zones in the Lombardy region. The training of the Voluntary Ecological Wardens combines teaching about the characteristics of the natural park (animal and plant species, geological characteristics, etc.) with teaching about the National and Regional laws for environmental protection.

Another example of the many activities in environmental education for the public are training courses for trade union workers, such as courses organised by the Italian Confederation of Workers in Bologna. In these courses, environmental problems are discussed in the context of their impact on union activities.

VIII. Propositions for future analysis

The results of this primary analysis of training activities for environmental protection in the Lombardy and Umbria regions make it desirable to continue this research, including personal discussion with teachers and students about the most important didactic aspects of the courses and the fundamental issues in environmental protection training.

This future analysis can be focused on certain training courses that illustrate some of the more important problems in environmental protection training. The following courses are proposed for further analysis, because they respond to identified environmental training needs, and thus provide a particularly close link between training supply and employer demand

"Corsi di Monitoraggio Ambientale organisati par PROTECNOS" (Courses for environmental monitoring organised by PROTECNOS);

"Corsi di formazione professionale: Tecnici informatici per il monitoraggio ambientale. Tecnici per il risparmio energetico. Comuna di Grosio. (Courses for professional training: Computer technicians for environmental monitoring. Technicians for energy conservation). Grosio Comuna;

"Integrated project for the professional territory and environmental information technicians training." Sondrio Province;

"Ambiente e territorio: La contratazione Territoriale. Corso di formazione per dirigenti sindicale." CGLI (Environment and territory: Training course for trade union leaders, Italian General Confederation of Work). Bologna.[1]

[1]Editor's note: These programmes will be examined in a forthcoming Training Policies Discussion Paper.

Conclusions

The Italian employment market for environmental protection changes rapidly. It does not yet offer a clear definition of job profiles.

It is difficult to clearly define occupational profiles in environmental protection, because it is difficult to distinguish the limits of action and the necessary educational and experiential background for each occupation.

Different professions compete for funding for environmental protection programmes. The relations between them are unclear, as each has its own particular approach and specific jargon that complicates the co-ordination of their efforts.

It is necessary to decide if new occupational profiles in environmental protection are needed and what their relations with existent occupations should be. Environmental management should probably be organised as a new occupation, because it is a combination of environmental sciences and human sciences.

Some of the new technicians engaged in environmental protection activities are not clearly recognised by the employment market. The students of some courses in environmental protection have asked for official recognition of their studies.

Training for environmental protection can be a useful response to the unemployment of young secondary school leavers. However, rapid changes in the employment market stimulate the organisation of training courses oriented to highly specialised professional profiles. This tends to limit the job opportunities for graduates of the courses, and it decreases their job mobility.

The use of a "module"-based system in which specialisation would occur only after the completion of a basic "core" curriculum, might allow more flexibility for the training programmes.

Certain didactical problems must be addressed in order to improve the effectiveness of courses in environmental protection. First, the Italian education system must be expanded to develop the capacity of students to deal with complex systems and networks of cause/effect processes. Second, in order to address the complexity of the subject, information must be included from different sciences, including ecology, informatic and social sciences, economics, chemistry, jurisprudence, etc. Furthermore, an adequate balance must be established between a "global" approach and an "analytical" approach. This balance may be obtained not only through the participation of teachers from different professions, but also through reorganisation of course contents and activities.

A lack of information about existing training and employment opportunities in the environmental protection area makes it difficult for prospective students to decide upon programmes of study which will fulfill employment needs. Therefore, a labour market information system for the environmental training market is needed to provide a link between school leavers and potential employers.

Currently, there is a gap between the skills and knowledge developed in schooling and the necessary skills and knowledge for environmental protection activities. In the Lombardy and Umbria regions, ad hoc courses have been created to try to fill this gap. However this urgent action is insufficient, and the need to solve this problem at the school level becomes more and more apparent. In Lombardy and Umbria, some teams of researchers in didactics are analysing this problem.

Examples of courses in environmental protection in the Lombardy and Umbria regions

A. Examples of the training in environmental protection for professionals and technicians

There are two kinds of training courses in environmental protection available to professionals and technicians: long training courses, in which complex networks of knowledge and skills are developed; and short training courses, in which knowledge and skills for specific activities are developed.

We will give examples of both approaches.

1. Long training courses in the "Istituto di Ricerca Farmacologica Mario Negri" (Mario Negri Institute for Pharmacological Research)

The Mario Negri Institute for Pharmacological Research is a scientific organisation for research and education in the biomedical field. The Institute's three main fields of concentration are cancer, mental and nervous system disorders, and cardiovascular diseases. The Institute also conducts research programmes on kidney diseases, toxic effects of environmental pollutants, several rare diseases, pain, and addictive drugs. In addition to research, the Institute's educational programmes range from training for laboratory technicians to post-graduate courses in pharmacology.

Fourteen post-graduate students are attending long training courses in the Institute. After the students are selected, they start to work in one of the Institute's laboratories. For example, some students work in the Neurochemistry Laboratory, analysing the effects of pesticides on molecular receptors in the nervous systems of mammals. The training lasts three years and is funded by a small grant from the Institute and the EEC.

The training emphasises concrete research, and the students participate in the current activities of the Institute (for example, they attend internal seminars three times a week). The students are guided by researchers from the respective laboratories and are taught the theory and the skills necessary for future employment activities. Each student is responsible for all aspects of a research project, from an analysis of the initial bibliography to the writing of scientific papers. After the training, the students should be able to work autonomously in industrial laboratories or in research centre laboratories.

One example of such a course is the training organised by the Ecotoxicology laboratory on the toxic effects of chemical pollutants. This research is divided into two main categories:

> The measurement of the concentration of pollutants in the air, water or soil, using techniques such as mass spectro-photometry (measuring light absorption);
>
> The measurement of the effects of the pollutants on animals; for example, their mutagenic effects, their linkage with proteins and DNA, their cancerous effects, their removal by the kidneys, etc., using physiological and molecular biological techniques.

These activities require the use of theories and instruments from different disciplines (molecular biology, biochemistry, analytical chemistry, etc.). For this reason, the researchers and the technicians who work in environmental toxicology must undergo long and intensive

training in order to acquire complex scientific knowledge and to develop difficult skills which complement their own of basic training.

The Director of the Ecotoxicology Laboratory and one of the students, a woman who entered the training programme two years ago, were interviewed.

The Director of the laboratory gave an overview of training activities. He explained that the students must be highly motivated, because the grants are small and the work is very intensive. He also emphasised the importance of "immersion training" that exposes the students to all the current activities in research, including the negative aspects.

The student, who is working on the monitoring of pesticides in water and their in vivo effects on rats, studied previously at the University of Milan, where she completed a Doctoral Thesis in ecology. She emphasised the differences between the studies she did at the University (mostly theoretical) and the characteristics of her training at the Institute, where she learns how to organise autonomous research. She confirmed the comments of the Director of the laboratory about the importance of "immersion training".

This training model alleviates one of the most important problems in training for environmental protection: it provides students with the necessary background to work autonomously in industry or in scientific research. The fact that environmental problems can be solved only through the integration of the activities of different disciplines and the rapid development of new research technologies justifies the introduction of "immersion" post-graduate courses.

2. Short training courses organised by the "Politecnico di Milano" (Milan Polytechnic)

Milan Polytechnic has organised several short courses for the training of engineers. Some of these courses are oriented towards environmental protection:

a. "Descripzioni Fractali in Ingenieria Ambientale" (Course for Fractals Description in Environmental Engineering)

Course organised by the Institute of Hydraulics.

The concept of "fractals," first developed by Benoit Mandelbrot, permits a better understanding of the possible "scales of similarity and affinity" for the description of natural phenomena.

This concept can be applied to solve problems in environmental engineering. In particular it can be useful for the observation, measurement and representation of environmental parameters and the elaboration of environmental models.

The course gives an introduction to fractals, followed by a presentation of their application to specific problems of topography, environmental engineering, and hydrology. The participants learn to solve different engineering problems using fractals.

Participants in the course are usually researchers from public and private enterprises working in environmental sciences, civil engineering and environmental engineering. The teachers are twelve professors from the Universities of Milan and Pavia, and from the National Council for Research. The duration of the course is 6 hours a day, for three days. The fees are 700.000 Liras (around USA $ 600).

b. "Metodi e strumenti per la valutazione di impatto ambientale" (Courses on methods and instruments for environmental impact assessment)

Courses organised by the Department of Electronics.

Environmental impact assessment (EIA) is one of the most recent approaches to environmental management and planning. Decision making is one of the central problems for EIA in the public environment, because it requires the co-ordination of participants from many different disciplines. Professionals from each discipline have different approaches, different jargon and, sometimes, different interests.

The use of information processing can be a big help in EIA, as it permits long and complex calculations and iterations and it "forces" the user to express technical jargon clearly. The training project SILVA (Software Interattivo per la Valutazione di Impatto Ambientale - Interactive Software for the Evaluation of Environmental Impact) teaches appropriate methods and instruments for the management of EIA activities.

In 1990 the SILVA project was organised into three courses:

The basic course. This course includes the use of software for a given project on the orientation and organisation of EIA activities, the analysis of the territory and the project, the evaluation of impacts, and the evaluation of and support for the final choice;

A theoretical course about the methodology for EIA;

A course explaining the use of software for EIA.

The basic course is intended for professionals working in EIA. The other two courses are for training and specialisation and require a good knowledge of the subjects covered in the basic course.

The fees are : Liras 1.200.000 (around USA $ 1,000) for the basic course and Liras 800.000 (around USA $ 670) for each of the other two courses. The number of participants is limited to thirty. The courses have one computer for every four participants.

Refer to Annex 2 for detailed course descriptions.

c. XXXVII Corso di Aggiornamento in Ingenieria Sanitaria : Inquinamento e protezione dell'ambiente: fenomenologia e prevenzione. (37th Course for Permanent Training in Sanitary Engineering Pollution and Environmental Protection : Phenomenology and Prevention)

Course organised by the Institute for Sanitary Engineering of the Milan Polytechnic and the National Association of Sanitary Engineering.

This course is intended for graduates in technical disciplines, such as technicians and professionals who work in sanitation (for example, in the Po and Lambro rivers and the Adriatic Sea) and in the evaluation of environmental impact. In some cases, non-graduate technicians can be admitted.

The course addresses the technical and scientific aspects of air, water and soil pollution and the criteria for environmental protection. It is divided into five sections, which include the following subjects:

General themes about environmental standards, sciences and techniques;

Specific problems in measuring pollution in the air, surface water, subterranean water and the soil;

Normative and technical aspects of the evaluation of environmental impact;

Ecotoxicological implications in the evaluation of environmental impact.

The duration is five full days. The fees are 800.000 Liras (around USA $ 700).

Refer to Annex 2 for detailed course description.

3. Short training courses organised by FAST (Federazione di Associazione Scientifice e Tecnice - Federation of Scientific and Technical Associations)

The Federation of Italian Scientific and Technical Associations organises short training courses for scientific researchers and technicians. Some of these courses are oriented towards environmental protection.

a. Impianti biologici di depurazione (Course in Biological Systems for Sewage Disposal)

In Italy, thousands of sanitation installations do not work satisfactorily. The project organisers accuse the managers of being incapable of correct management, and the managers accuse the project organisers of incorrect installations.

In response to this problem, FAST has organised two courses, a basic course and an advanced course, specifically directed towards the managers of installations for sewage disposal.

The basic course is intended for operators in sewage disposal installations and especially for those who are new to this activity. The course provides a fundamental understanding of the phenomena linked with the sanitation process. Computer simulations permit an analysis of the effects of various modifications of the process' variables This understanding will facilitate the management of both standard and emergency situations.

The advanced course was created in response to new standards for prevention of the euthrophication of lakes and of the Adriatic sea. These standards require the removal of nitrogen and phosphorus by most of the installations for sewage treatment. Although the adapted biotechnologies are new to the Italian market, more than one hundred of these installations will be built in the next three years.

The advanced course will train qualified technicians for the management of these complex installations. The course is addressed to managers of sewage treatment installations who have more than one year of experience, and for technicians and professionals who work in related activities.

This course is an example of the necessity for planning professional training activities for new systems for environmental protection.

The fees are 950.000 Liras (around USA $ 800) for each course, place 19 % IVA, and Liras 1.700.000 (around USA $ 1,400) for both courses, place 19 % IVA.

Refer to Annex 2 for detailed course descriptions.

4. Long training courses organised by "En.A.I.P. Lombardia - Ente ACLI per l'Istruzione Professionale" (Institution of the Italian Christian Workers Association for Vocational Instruction)

The ACLI (Associazione Cristiana di Lavoratori Italiani) is one of the biggest Italian workers' organisations. The En.A.I.P., one of its subsidiary institutions, promotes professional instruction. As a result, the En.A.I.P. is one of the largest training facilities for professional activities in Italy. Twenty five percent of the professional instruction in the Lombardy region is organised by the En.A.I.P in conjunction with public institutions. The En.A.I.P. has 150 "territorial units" and its budget is 26 billion Liras per year (around USA $ 32 million).

One of the En.AIP's goals is to promote vocational instruction for unemployed youth. The En.A.I.P. organises tailored courses after analysing the specific needs of the employment market. For this reason, the analysis of the En.A.I.P.'s training activities can be a good

indicator of the specific skills and knowledge demanded by the Italian employment market.

Discussions were held with those responsible for training about some of the activities of En.A.I.P in the Lombardy region and the Province of Sondrio.

One of the training activities related to environmental protection organised by En.A.I.P. Lombardia is linked with the development of "agrotourism", which is a method of developing tourism without a negative impact on the environment.

A first project, called OPTURNEA - Operatore per il Turismo Naturalistico e l'Educazione Ambientale (Operators for Tourism and Environmental Education) - was organised with the aim of training fifteen young, under 25, unemployed school leavers in agro-tourism.

This training course lasted four months, or 600 training hours. Unfortunately, this first experience proved that environmental education and tourism activities require a long training period, and consequently, the obtained professional profile did not correspond with the needs of the employment market.

For this reason, a second project was organised whose goals were not exclusively directed towards tourism activities. It was called Progetto (project) TASSO.

a. Progetto TASSO (Agroturismo)

En.A.I.P. Lombardia (Ente ACLI per l'Istruzione Professionale).

Progetto TASSO aims to develop tourism without negative impacts on the environment in the Lombardy region. In addition, the project is oriented toward solving the unemployment problems of young people.

The programme trains "environmental tourist agents" ("operatori turistico ambientale") who organise tourist activities compatible with environmental protection.

At the end of the course, the students should be able to:

Promote and organise tourist activities;

Co-ordinate physical, economical and human resources;

Know the region in detail.

The course is intended for young people (18-25 years old) who have completed their senior secondary schooling. It lasts 460 hours: 270 in classrooms, 40 for didactic visits, and 150 for practical experiences.

After examination by a commission at the end of the course, the participants obtain a qualification that is recognised by the Lombardy region and by the European Social Fund.

Refer to Annex 2 for detailed course description.

5. Long training courses organised by En.A.I.P. SONDRIO

The Province of Sondrio is the least developed of the provinces in the Lombardy region. In its mountains and valleys, the population works mostly in agricultural and tourism activities. The region has suffered environmental disasters caused by geographical characteristics, atmospheric conditions, and human activities.

The transformation of the region's economy, which has caused the exodus of agricultural workers, has been one of the causes of these environmental problems.

The weakness of Sondrio's economy and its small population (around 180,000 inhabitants) are limiting factors for the employment market. Because young people cannot find jobs, they emigrate to other regions of Lombardy.

En.A.I.P. Sondrio is searching for a solution to this situation by organising training courses which respond to the expressed needs of the enterprises in the province. The courses each have twenty participants who are generally young people with few qualifications (most have finished only compulsory education).

Most of the courses last one year (900 class hours) with 300 hours of practical activities in enterprises of the region. Usually, the students continue working in the enterprises where they did their practical training.

These practical training activities are monitored on a weekly basis by the organisers of the course, to assess both the students' work and the working conditions.

The courses' programmes are decided in collaboration with enterprises that express the need for a particular occupational profile, which then forms the basis for a course outline. This system helps to reduce the gap between enterprises needs and the school leavers' background, and it also increases job opportunities for young people in the region.

The teachers are professionals and technicians who work in areas related to the courses. The annual budget for the courses is 200/250 million Liras (USA $ 170,000/210,000). They are financed by the European Social Fund (50 %) and by the Lombardy region (50%).

Some of En.A.I.P. Sondrio's courses are specifically directed towards environmental protection. For example:

"Corso di operatori per la manutenzione del territorio" (course for territory maintenance operators) that will be organised in the next year for middle-level secondary school leavers;

"Corso per tecnici di territori di montagna" (course for technicians in mountain territories). A post-graduate course for geometers organised in 1989;

"Corso per florovivaisti e manutentore del verdi" (course for operators in green surfaces of public parks). This course will be organised in 1991 with the aim of promoting employment for "marginalised" young people who did not finish obligatory schooling and have not developed the necessary skills and knowledge to obtain employment.

6. Integrated project for professional territory and environmental information technician training

As a result of a 1987 flood which devastated the Valtellina region in northern Sondrio, the area is now "convalescent". The co-ordinated efforts of the Italian state, the Lombardy region and, fundamentally, the people of Valtellina, have permitted the region's recovery from the debilitating effects of the mud. This recovery has required not only direct action to repair the disaster's consequences, but also the organisation of monitoring systems to prevent future ecological disasters. A new training project, which is an example of the potential for co-ordination between private and public enterprises, was organised to provide professionals with the skills to manage these monitoring systems.

The "Integrated Project for the Training of Environmental and Territorial Information Technicians" was organised with the aim of creating new qualified specialists in the computerised handling and monitoring of the Valtellina land.

The project is assigned to 50 young professionals and/or graduates under 25 years of age. The courses are entitled "Territorial Data Gathering and Input Specialists" (25 participants), "Information Systems Manager" (10 participants) and "Territory Administrator" (15 participants).

The "Integrated Project for the Training of Environmental and Territorial Information Technicians" was organised under the programme framework of the European Social

Fund, the Lombardy Region and an association of private enterprises: Digital Equipment, Dagh Watson, Cooperativa Rilancio Valtellina (Co.Ri.Val) and I.S.M.E.S. SpA."

Digital Equipment is the Italian subsidiary of the Digital Equipment Corporation, whose headquarters are located in Maynard, Massachusetts, USA.

Dagh Watson SpA is an Italian engineering and technical-economical consulting company that operates worldwide on territorial and environmental problems and owns equipment for surveying and for environmental, hydrological and geophysical research.

Co-operativa Rilancio Valtellina (Co.Ri.Val.) is an enterprise which controls, monitors, and collects hydro-geological data. Its priorities are youth employment and the introduction of new technologies applicable to the management of the territory and the environment.

The creation of an integrated training project will be a concrete reply to a community problem and a first step towards the development of a permanent centre for the collection, analysis, and dissemination of data about the territory.

In addition to the project's obvious educational and job creating goals, which make it unique in Europe, the project also represents an effective information exchange between public institutions and private enterprises. A goal is to produce, through a public and private common effort, accurate planning values which will enable similar projects to be created in other regional environments.

The project also provides a model of the effective co-ordination of interrelated disciplines from the information world, the environmental sciences, and intervention in the territory itself in order to allow for attentive and rational territorial and environmental planning. In this way, it represents a unique training opportunity for young people trying to enter the job market.

The interaction of enterprises in programmes of research on environmental protection produces not only a qualified scientific and technological information base, but also the beginnings of close co-operation between private enterprises and public institutions to provide the most efficient management of environmental systems.

Refer to Annex 2 for detailed course description.

7. Long training courses organised by the Grosio commune

Grosio is a small mountain commune in the Province of Sondrio, with a population of 5,000 inhabitants. The Commune has organised several activities for environmental protection:

A pilot project for environmental monitoring using solar electronic devices, in collaboration with a French enterprise that produces photovoltaic material and with the Soviet Academy of Sciences;

The use of Soviet satellites for the elaboration of the map of Valtellina region;

The organisation of seminars about environmental protection and the use of solar electronic devices;

The Commune is also organising training courses financed by the European Social Fund and managed and controlled by the Lombardy region. These courses are intended for school leavers above the level of medium secondary school, and the obtained qualification is accepted by the Lombardy region and the EEC. The students receive a small grant of 200.000 Liras a month, (around US $ 160). Fifty students were selected from 150 applicants;

One interesting result of the training courses was the organisation of a co-operative society that prepared a US $ 60.000 project for a German enterprise.

a. "Corsi di formazione professionale : Tecnici informatici per il monitoraggio ambientale. Tecnici per il risparmio energetico. (Courses for professional training: Computer technicians for environmental monitoring. Technicians for energy saving)

These courses are intended for secondary high school leavers. The idea is to train "marketing oriented" technicians who will be able to analyse the environmental protection market and propose new alternatives, search for new clients, and organise the necessary technical and economic consultations with related experts. These technicians should be able to "sell" their expertise in environmental protection, both in environmental monitoring and in energy conservation.

8. Long training courses organised by the Umbria region

The Umbria region is part of the "Integrated Programme for the Mediterranean" of the EEC.

Training activities for environmental protection undertaken by the Umbria region are oriented towards environmental education, "environmental tourism," environmental and territorial management, and the environmental imact of the agro-food industry.

Umbria will also develop the "European Centre for Environmental Training."

Like the Lombardy region, the Umbria region attempts to fill the gap between training offered in schools and universities and the changing needs of the environmental protection employment market. However, the fact that Umbria is the smallest of the Italian regions (with only 800.000 inhabitants) is an element that makes the organisation of a large-scale regional training system for environmental protection more difficult.

The Umbria region has developed two solutions which address the problem of training the needed professionals and technicians for highly specialised activities without developing a large educational system.

One solution is the organisation of an "international" training programme, in which students visit different European training centres related to their studies in environmental protection. This programme is currently training twelve students.

Another solution is the participation of highly specialised private enterprises in environmental protection training, as illustrated by the following example:

PROTECNOS (Projetazione Tecnologica Innovativa - Innovative Technological Planning) is a consortium for the development of training activities related to civil engineering and computing systems.

PROTECNOS is a response to the need for professional training in environmental protection. The Umbria region called upon different enterprises to organise the training, and then organised the consortium.

The participating enterprises are:

RPA - Risorse Ambientali SpA. (RPA-Environmental Resources SpA.). This is an enterprise which works in the solution of environmental problems, such as studies for sewage treatment installations, fluvial basins, environmental recuperation, socio-economic environmental problems, subterranean waters, soils and atmospheric pollution, rubbish treatment, etc.

STAER - Società di Topografia ed Ecofotogrametria (STAER - Society for Topography and Ecophotogrametry). This organisation specialises in the analysis of satellite data, the organisation of data banks, software, etc., in order to treat "crossed information" for the analysis of agriculture, soils, prevention of ecological disasters, etc.

GESIM - Gestione di Impianti e sistemi informatici e consulenza impiantistica (GESIM -

Installations' management, informatic systems and consultants for installations). This enterprise works in various projects, including the EEC CORINE project (Data Bank on environmental problems), and Project SIGLA (monitoring of Lake Trasimeno water).

The above-mentioned activities are highly specialised. For example, Project SIGLA requires the continuous measurement of the water parameters of Lake Trasimeno, as well as the collection, radio transmission, treatment and "real time" analysis of data. This project is one of the first elements of a developping European system for environmental monitoring.

The enterprises use the most sophisticated instruments and software for these activities. Therefore, these systems are also used by students in the training courses organised by PROTECNOS. The students are trained in the use of leading systems in environmental monitoring and treatment of environmental data.

Refer to Annex 2 for detailed course descriptions.

B. Examples of training activities in environmental protection for the population

To illustrate the training activities in environmental protection addressed to the general population, we have identified some training activities undertaken by the Lombardy Region.

The region of Lombardy, in northern Italy, has very extensive industrial development and a high population concentration in urban areas. Both factors have contributed to a deterioration in the quality of life and negative changes in the environment, such as air and water pollution, extinction of species, soil degradation, etc.

The region controls twenty Regional Natural Parks (that correspond to 20 % of the territory) and one hundred Regional Reserves.

The region's "philosophy" for environmental protection is to address the public directly. Public education about the necessity to limit activities that can provoke negative changes in the environment is one approach. Also, decentralising the control and management of the environment stimulates the participation of the population in these activities. This philosophy aims for less repression of activities which have a negative impact on the environment and more education to discourage those who act against the environment.

This philosophy is the foundation of five important activities organised by the Region:

The organisation of a "Voluntary Ecological Wardens" programme ("Guardia Ecologica Volontaria") charged with the environmental policing of Regional Natural Parks, Regional Reserves and Protected Zones;

Collaboration with different institutions for environmental education and training for environmental protection;

The organisation of a data bank which includes all of the activities for environmental education in Lombardy;

Collaboration in the organisation of "Environmental Referential Centres" (Centri Referenziale per l'Ambiente") in the Provinces' Capitals;

Collaboration in the training of technicians in Environmental Protection.

1. The Voluntary Ecological Wardens

According to its environmental philosophy, the region decided to promote the control and management of the environment by local authorities and the local population, both by stimulating the participation of local institu-

tions and by training citizens to control the environment.

The region decided to establish a "corps of citizens" charged with monitoring the environment and enforcing the laws for environmental protection. The concept of "diffusion of responsibilities about environmental protection" was put into practice by Regional Law No 105 of December 28, 1980, which established a "Corps of Voluntary Ecological Wardens"

("Guardia Ecologica Volontaria"). This corps was to be made up of any citizens who "had no previous criminal indictment and had completed [their] obligatory military service," who would be selected by a Commission after an intensive training course covering environmental protection laws and basic knowledge about the environment of the region.

This Corps of voluntary citizens acts as an "environmental police" charged with reporting violations of environmental protection laws. The Corps also has the power to impose fines for these violations.

The advantages of this system are:

Environmental protection is done by local people, who are familiar with the area and local problems. As they are not "strangers" to the population, they can respond to its sensitivities;

The Corps is composed of volunteers. Consequently, their actions are motivated neither by money, nor by the political pressures which can influence public officials;

The Voluntary Ecological Wardens can participate effectively in campaigns for environmental education. Because they are very familiar with the population, they can be helpful at diffusing information about proposals and problems in the environmental scope;

The Voluntary Ecological Wardens can "fill the gap" between the administration and the population, and help to ensure that the population becomes more aware of and more concerned about environmental protection laws.

The Voluntary Ecological Wardens have the following functions:

To diffuse information about the environment;

To organise activities in schools, such as courses, exhibitions, and visits to natural parks and protected regions. For example, the Wardens have recently organised "ecological visits" to natural parks and protected zones for 5,000 pupils of Milan's schools;

To collaborate in the development of maps with environmental information for the benefit of the public;

To collaborate in environmental protection;

To participate in activities to protect the environment in cases of ecological disasters. For example, in 1988, 250 Voluntary Ecological Wardens cleaned 4,000 tons of rubbish after the avalanche of the Lada river in the alpine region of Valtellina (Province of Sondrio);

To control the environment by observation of the animal and plant communities and to inform the authorities about the "environmental health" of the protected regions;

To inform the authorities about violations of environmental protection laws and to incur fines when called for.

In Lombardy there are about 2,000 Voluntary Ecological Wardens organised into 59 teams. The training course has also been successfully completed by 800 citizens who are awaiting nomination. Since the initiation of these activities, between 8,000 and 10,0000 citizens have completed training courses.

The training courses for the Ecological Wardens must reflect the two essential types of activities in which they are involved: control activities (observing the environment) and policing functions (enforcing environmental laws). Therefore, the training is organised around two axes: an "ecological axis" and a "legal axis."

Refer to Annex 2 for detailed course description.

The activities of the Voluntary Ecological Wardens are an example of effective environmental protection through "transfer to the population" of basic knowledge about the laws for the protection of the environment and the characteristics of plants and animals in the protected regions.

However, after examining the manuals for the training of the Wardens, there seems to be a "bias" towards the "naturalistic" aspects of the environment (i.e., descriptions of animal and plant species typical of the region) with less emphasis on the "dynamic" aspects (i.e., ecosystems and their relationship with human activities). Thus, although the Ecological Wardens help in organising the public for environmental protection, the training programme could be more effective if it were oriented to the relations between industrial and economical activities and the structure and dynamics of ecosystems and physical, chemical, geological and atmospheric systems.

2. Other environmental education activities in the Region of Lombardy

In order to improve environmental education for different sectors of the population, the Region of Lombardy has established connections with the Universities of Milan and Pavia, with the "Regional Institute for Didactic Research and Teachers Training of Lombardy" ("Istituto Regionale di Ricerca, Sperimentazione e Aggiornamento Educativi - IRRSAE - Lombardia"), and with several Associations for the Protection of Environment.

Another important activity of the Region of Lombardy is the organisation of "Referential Centres for Environmental Education" in the Province Capitals. These centres have organised activities such as:

A campaign for adoption of "differentiated collection of domestic rubbish" policies in Milan;

The organisation of a competition on "Research on Rubbish" in the city of Monza;

The establishment of a laboratory for the recycling of paper;

The creation of a course for residents, the "Residential Course for Environmental Education," in the city of Brescia;

The Lombardy region of has also organised:

Courses for environmental education and for ecology with the University of Milan;

Course on fauna-mapping;

Course for "agro-tourism" in the Lake of Como;

Cycle of conferences about "Living Nature - Dying Nature", organised in collaboration with the University of Milan;

Pilot Project "Informambientenaturdata" (Database): a system for giving the population information about natural phenomena and the processes of degradation of the environment (Presentation September 15th 1990);

An accord with the regional Park of Ticino and the University of Pavia for the training of school teachers in environmental education and the use of the park's installations for the organisation of educational activities for students.

C. Examples of training activities in environmental protection for trade union leaders

Members of the "Confederazione Generale Italiana del Lavoro" (Italian General Confederation of Work) of Bologna have organised a training course in environmental protection for high-level trade union leaders.

The course "Ambiente e territorio: La contratazione Territoriale. Corso di formazione per dirigenti sindicale" (Environment and territory training course for trade union leaders) addressed the environmental problems that have an impact on the participants' activities. In particular, environmental problems linked with trade union activities were focused upon. The discussions were directed towards a specific territory, the Reno basin.

The organisation of the course followed an "inductive model," starting with the participants' thoughts and opinions about environmental problems, followed by the treatment of the proposed points by experts. This method allowed the participants to decide which problems needed the most attention and information.

Refer to Annex 2 for detailed course description.

Detailed course descriptions

A.Course descriptions for 1.2.2 "Methodi e strumenti per la valutazione di impatto ambientale" (Course on methods and instruments for environmental impact assessment)

1. The Basic Course

The Basic Course has a duration of 5 days. It is an introduction to the SILVA project and is divided into three steps:

Introductory step: for the orientation of studies in normative aspects, the collection of significant information, the analysis of territory and the generation of alternatives. In this step, expert systems such as SERENA (Sistema Esperto per la Ricerca e l'Elaborazione di Nessi Ambientale - Expert System for the Research and the Elaboration of Environmental Nexus) and other programmes for the analysis and the representation of territory can be very useful.

The second step seeks to organise the qualitative results of forecast models into the format of "coaxial matrices", in which the files and columns are defined using an ensemble of control lists. In this step, the "electronic leaf" GAIA "Guida all'Analisis di Impatto Ambientale" (Guide for the Analysis of Environmental Impact) is used.

The third step seeks to analyse the conflicts involved and to generate the necessary information for decision-making. This step is based on the "multiple attribute" analysis technique, which uses criteria such as weighted addition, risk-minimisation, worst case, etc. to eliminate undesirable alternatives. A computer support system VISPA "Valutazione Integrata per la Scelta tra Projetti Alternativi" (Integrated Evaluation for the Choice between Alternative Projects) is used to help decision making.

During the the Basic Course the SILVA Project is discussed as a whole, and the course includes the study of EIA (environmental impact assessment) and the use of the SERENA, GAIA and VISPA programmes.

Participants are required to have a technical or scientific background and a good knowledge of the problems and workings of EIA.

2. Course on Evaluation Methods

In this course, methods of cost/benefit analysis and multiple attribute analysis are introduced with respect to their use in EIA. In particular, the following are discussed:

Direct and indirect methods for economic evaluation of natural resources and environmental resources;

The extension of a cost/benefit analysis to the problems of territorial planning (for example, the use of accounts balancing for development and the use of matrices for the obtention of resources);

Legislative criteria (environmental norms and standards, taxes, grants, licences) and their effects;

Analysis of preferences (value function, tendencies to risk, utility function);

Use of the decision tree for the analysis of risk;

Final discussion and evaluation of the course;

The efficiency criteria of Pareto;

The methods of weight attribution founded in pair confrontation;

Decision criteria that are useful for ranking the alternatives (weight additions, max-min, etc.);

Analytical methods of multiple attributes, such as ELECTRA, founded on matrix of concordance and discordance;

The hierarchical analysis of Saaty.

3. Course for the use of software

During this course, participants perform a simulated EIA analysis, using the GAIA and VISPA programmes. The participants must define the problem, analysing the environmental norms for similar cases and the information available (data, cartography, decision structures, related social groups, significative alternatives, etc.).

After the problem is defined, the participants use the GAIA programme for the logical organisation of the analysis and for the co-ordination and representation of impact estimation and prevention as given by experts. The participants then assemble a matrix by organising the lists hierarchically. They should also collect the original impact-estimation and forecast, transform qualitative information into numerical estimations, and perform aggregation and segregation for the obtention of the evaluation matrix.

The evaluation matrix, obtained using the GAIA programme, is used with the VISPA programme and permits doing all the necessary operations for making decisions: the normalisation and the transformation of effectiveness indicators using utility functions and aggregation methods; the attribution of coefficients of relative importance (weights) to different goals, using the pair-confrontation method; the arrangement of alternatives using such criteria as partially weighted addition, worst case, concordance and discordance, weak domination, etc; and the elimination of unsatisfactory alternatives.

B. Course description for 1.2.3 "XXXVII Corso di Aggiornamento in Ingenieria Sanitaria: Inquinamento e protezione dell'ambiente: fenomenologia e prevenzione" (37th Course for permanent training in sanitary engineering: pollution and environmental protection: phenomenology and prevention)

Course Programme:

Air quality:

Air protection norms;

Informatic system for the management of middle-scale air quality;

General criteria for the evaluation of the emission of atmospheric pollutants;

General criteria for the control of the air's quality (framework for the sampling);

Generalisations about models for transport, diffusion and deposit of atmospheric pollutants;

Calculation code and examples of its applications;

Estimation of the emission of atmospheric pollutants that are toxic and persistent. Methodology, calculation code and examples of its applications.

Phytopharmaceutical:

National and international norms for ecotoxicology;

Criteria for the evaluation of ecotoxicological risks;

Application of ecotoxicological models to pollution with phytopharmaceutical components.

Water quality:

Water protection norms;

Phenomenology and criteria for protection of surface water;

Evaluation models for pollution in rivers, lakes and seas;

Criteria for the protection of subterranean water.

Soil protection:

Solid waste norms and classification;

Criteria for the recuperation of polluted areas.

Environmental impact:

National and regional norms for the evaluation of environmental impact;

Index and indicators of environmental impact;

Examples of calculation codes for the evaluation of environmental impact.

C. Course descriptions for 1.3.1 "Impienti biologici di depurazione" (Course in biological systems for sewage disposal)

1. "Corso base sulla gestione di processo" (Basic course for process' management)

Course Programme:

Introduction

Characteristics of sewage liquids:

Legislation;

Sampling;

General schema of installations for sanitation;

Primary treatment and sedimentation.

Principles of biological treatment of sewage liquids:

Mire activity;

Process, control and pathology of mires;

Nitrification and denitrification;

Percolator-beds;

Bioschists: theory and software for projection;

Anaerobic digestion of mires: computer simulation;

Mires' dehydration;

Microscopical and microbiological control;

Mires' activity: computer simulation and management;

Description and technical visit to the Sanitation Installation "San Rocco":

Process control and instrumentation;

Analytical control.

1. "Corso avanzato sulla gestione dei sistemi di rimozione dell'azoto e del fosforo" (Advanced course for management of systems for removal of nitrogen and phosphorus)

Course Programme:

Eutrophication control;

Sources of nitrogen and phosphorus in sewage. Legislation and analytical techniques;

Principles of bacterial kinetics;

Nitrification and denitrification;

Schema of the installations for removal of nitrogen and phosphorus;

Active mires with nitrification and denitrification;

Advanced simulation of processes of nitrification and denitrification;

Chemical and biological methods for the removal of phosphorus;

The installation for sewage treatment "Phostrip of Cervia;"

The installation of sewage treatment "denitro-nitro" of Mortara;

Management simulation;

Technical visit to the installation for sewage treatment "denitro-nitro-Prem" of the Varese Lake;

Process' control and instrumentation;

The installation of Venice-Porto Marghera.

D. Course description for 1.4.1 "Progetto TASSO" (Agroturismo)

The content of the course is organised in three areas divided into modules:

First area:

Basic knowledge of computer science;

Systemic approach;

Ecology and models for interpretation.

Second area:

Access and viability;

Infrastructure.

Third area:

Organisation and services.

The goal of the course is to develop practical skills and a theoretical basis. The course is orientated towards practical activities such as:

Direct application in the field of the theoretical concepts;

Simulation of touristic activities;

Case study of touristic activities;

Practical experiences in the territory concerned, where the students participate actively in real activities.

In each module the training is given by several teachers. A course supervisor coordinates and integrates the teachers'activities. The supervisor is also responsible for the introduction to the module and the direction of the final discussion with the participants.

E. Course description for 1.6 "Integrated project for the professional territory and environment information technicians training"

Training courses:

The project trains for three occupational profiles:

Territorial data gathering and input specialist.

Goals:

To use and install instruments and sensors for the surveyance of territorial data and possess the basic knowledge of environmental problems;

To be able to operate up-to-date systems of data processing, utilising application packages for data gathering.

Information systems manager

Goals:

To assess systems efficiency and data integrity. To programme through up-to-date languages and set up personalised procedures;

To run and up-date the installed informations systems.

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Territory administrator

Goals:

To apply theoretical and practical knowledge to the analysis of environmental problems;

To assemble information from the territorial data bank in order to represent the status of the territory, and to understand and utilise most effectively the processing system and the adopted application packages.

Course structure:

The courses will evolve according to the professional posts outlined in the project and will be structured in two phases:

Training phase: Training in the different disciplines outlined in the programme. This phase will end with a final evaluation and with the presentation of a project common to all three professional posts, based on the type of intervention developed in each course;

Effectiveness phase and experience exchange: Intended to ascertain the project's feasibility.

The courses will be organised in five consecutive modules for each professional post.

The modules are:

Introductory module;

Territorial competence module (informatic module);

Applied module;

Executive module;

Final evaluation.

F. Course description for 1.6 "Integrated project for the professional territory and environmental information technicians training" - "Corsi di formazione professionale: Tecnici informatici per il monitoraggio ambientale. Tecnici per il risparmio energetico" (Courses for professional training: Computer technicians for environmental monitoring. Technicians for energy saving)

The two courses have the following similar subjects:

Computer science;

Marketing and business organisation;

Radio transmission of environmental monitoring data;

Applications with sensors;

Alternative energies and energy saving;

Building using energy saving criteria;

Geology, mineralogy, meteorology, hydrotechnic;

Botany and environmental impact;

Building technology and technical operations for recovery;

Technical design.

The following subjects will be oriented for specialisation:

Projection and calculation;

Design of installations and practical exercises.

At the end of the training courses the students will be able:

To create and write their own computer programmes;

To use highly developed software for computer design and word processing;

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To work autonomously in environmental monitoring and conservation;

To analyse the costs and benefits of each alternative energy system or energy saving system;

To analyse the national and international markets for alternative energy systems, energy-saving systems and environmental protection;

To communicate with different social and economical sectors about environment and environmental protection issues;

To use different systems for environmental monitoring and transmission by radio of data;

To use different models for environmental protection and for energy-saving;

G. Course description for 1.8.1 "Corsi di Monitoraggio Ambientale organizati par PROTECNOS" (Courses for environmental monitoring organised by PROTECNOS)

The goal of these courses is to train young unemployed graduates as technicians in monitoring the environment. Fifteen participants were selected from two hundred requests for the places in the courses. There are three related courses:

Course on Management for establishing and organising regional natural parks. Three graduates in architecture were selected for the course;

Course on management, organisation and maintenance of natural parks. Four graduates in geology, two graduates in biology and one graduate in agricultural sciences were selected for the course;

Course for control and management of environmental monitoring systems of the hydric basin and the atmosphere of "Terni Basin". Three experts in chemistry and two laboratory technicians were selected for the course.

The three courses start with a common period of three hundred hours and continue with a period of specialisation.

In the classes common to the three courses, subjects such as the following were discussed:

National and regional norms for environmental protection;

Rubbish disposal and sewage treatment;

The geology of Umbria, focused on the study of thematic maps;

Studies of urban territorial planning;

Botany, geology, biology, chemistry, ecology;

Computer science (use of software such as Lotus 1-2-3 and wordstar 2000 plus).

Courses A and B have similar specialisation subjects, including:

Environmental planning;

Economic analysis;

Archeology;

Executive projection;

Urban territorial planning;

Applied geology;

Marketing;

Forestal botany;

Applied zoology;

Breeding.

The students from courses A and B consult with the populations of mountain areas and their representatives and apply the results of these discussions in planning environmental management in the natural parks of the region.

The specialised subjects for course C include:

Applied chemistry;

Instrumental analysis;

Meteorology;

Atmospheric pollution;

Sewage management and atmospheric pollution.

Chemical laboratory.

The students of course C visit several stations of the SIGLA system (monitoring of Lake Trasimeno) in order to perform chemical analyses of water and sewage. They also participate in the activities for the recovery of several quarries, analysing the soil. They pay several visits to installations for sewage treatment.

One particular problem mentioned by the students is that the regional and national authorities need to recognise the courses. Without such recognition, graduates are unable to compete for jobs in public administration.

H. Course description for 2.1 "Voluntary Ecological Wardens"

1. The initial training course for "Voluntary Ecological Wardens"

The training begins with 60 hours of initial training. At the end of this period, the students are examined by a commission. The training course programme consists of 19 points grouped into five sections:

Description of the Voluntary Ecological Wardens;

Protection of nature and the landscape;

Protection against pollution;

First aid;

Civilian protection.

The manual for the course is clear and attractive and it combines descriptions of natural systems with precise information about environmental protection laws.
The manual mainly describes the plants and animals of the natural parks. It gives little information about the structure and the dynamics of ecosystems.

2. "In service" training for Voluntary Ecological Wardens

The second phase of training can consist of a number of courses, including:

Course on environmental education;

Course on "Fauna sampling' ("fauna mapping") (Rilevamento Faunistico);

Course for "Park Wardens" (Guardia Park);

Course on environmental education in high mountain regions, with the participation of pupils from the city of Brescia. The course lasts 15 days and trains the Voluntary Ecological Wardens for environmental education activities in schools. More than 100 Voluntary Ecological Wardens have participated in this course.

I. Course description for "Ambiente e territori: La contrazione Territoriale. Corso di formazione per dirigenti sindicale" (Environment and territory: Training course for trade union leaders)

(First Module: 22/23/24 October 1990)

The programme of the course was:

First day:

Presentation of the course;

Team work: Context definition;

Discussion of the results of teams' work;

Expert presentation: Perception and reality of environment;

Discussion with the expert.

Second day:

Team work: analysis of problems and difficulties;

Discussion of the results of teams' work;

Expert presentation: government of environmental problems;

Discussion with the expert.

Third day:

Team work: elements of environmental policy;

Discussion of the results of teams' work;

Expert presentation: the hydrographical basin as a basis for economic analysis;

Team work: organising the questions to be addressed to the experts;

Questions to the experts;

Course's evaluation and presentation of the second module.

(Second module: 20/21/22 November 1990)

First day:

Presentation. Discussion of the first module;

Expert presentation: Law 183: The hydrographical basin and basin's authority;

Discussion with the expert;

Expert presentation: Relationship between application of laws and organisation of public services;

Discussion with the expert;

Expert presentations: territorial dynamics and environmental impact in the Reno hydrographical basin. Social-economic evolution. Urban specificities;

Discussion with the experts.

Second day:

Negotiation techniques for management of environmental conflicts. Theoretical aspects. Case discussions;

Collective discussion.

Third day:

Team work: establishment of environmental priorities in the hydrographical basin;

Team work: establishment of an appropriate model for a territorial contract that can be used to solve the environmental problems of the hydrographical basin;

Discussion of team work results and discussion with the experts.

Training courses in environmental protection

The following training courses in environmental protection in the Lombardy and Umbria regions were analyzed:

Corsi di Formazione Professionale: Tecnici Informatici per il Monitoraggio Ambientale; Tecnici per il Risparmio Energetico, Comuna di Grossio (Varenna), Provincia di Sondrio, Regione Lombardia, 1989.

Corso di Formazione Professionale: Tecnici del Territorio Montano, Regione Lombardia - Camera di Commercio, Industria, Artigianato, Agricoltura di Sondrio - Co.Ri.Val., Sondrio, November 1989 - July 1990.

Corso di Formazione Professionale "Tecnici Ecologico Ambientali."

Conzorzio Protecno - Centro Nazionale per la Formazione Professionale sulle Nuove Tecnologie di Progettazione - Regione dell'Umbria.

Corso di Formazione Professionale "Tecnici per l'Energia", Conzorzio Protecno - Centro Nazionale per la Formazione Professionale sulle Nuove Tecnologie di Progettazione - Regione dell'Umbria, 1989/1990,

Corso di Formazione per Tecnici per il Controllo Ambientale ed Impiantistico Conzorzio Protecno - Centro Nazionale per la Formazione Professionale sulle Nuove Tecnologie di Progettazione - Regione dell'Umbria, May-December 1989.

Corso Monitoraggio Ambientale, Conzorzio Protecno - Centro Nazionale per la Formazione Professionale sulle Nuove Tecnologie di Progettazione - Regione dell'Umbria, May-December 1989.

Corso di formazione rivolto a Operatore per il Turismo Naturalistico e l'-Educazione Ambientale, Progetto OPTURNEA, En.A.I.P. Lombardia - Boscoincitta - Italia Nostra, 7/9/1987 - 23/12/1987.

Corso TASSO (Turismo Ambiente Sviluppo Socioeconomico Occupazzione), En.A.I.P. Lombardia - C.F.P. di Bergamo, 28/7/1988-22/12/1988.

Progetto Integrato di Formazione Professionale per Tecnici Informatici, Ambiente e Territorio. Corsi: "Addetto alla raccolta e immissione dati territoriali."; "Gestore-responsabile del sistema informativo."; "Tecnico del Territorio." Sondrio, 1988/1989.

Training courses organized by FAST - Federazione delle Associazioni Scientifiche e Tecniche:

Corso di Formazione "Valutazione di Impatto Ambientale", Milan, 17-21 Sepember, 8-12 October 1990.

Seminario: "La Direttiva Seveso a un anno dal recepimento e i decreti d'attuazione, Milan, 22-23 May 1989.

Seminario: "Plani, Progetti e Studi di Impatto: Problemi delle Regione e Degli Enti Locali, Capri, October 31 1989.

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Training courses organized by Milan Polytechnic:

XXXVII Corso di Aggiornamento in Ingenieria Sanitaria: "Inquinamento e protezione dell'ambiente: fenomenologia e prevenzione.", Milan, 22-26 October 1990;

SILVA 90 "Metodi e strumento per la valutazione di impatto ambientale.", Milan, 21-25 May, 25-27 September, 9-11 October 1990;

Corso di Aggiornamento:" Descrizione frattali in ingenieria ambientale.", Milan, 9-11 October 1990;

"Impianti Biologici di Depurazione." Corso Base sulla gestione di processo, Milan 24-27 September 1990. Corso Avanzato sulla gestione dei sistemi di rimozione di azoto e fosforo. Milan, 1990;

"Modellistica e controllo dell'inquinamento fluviale" ruolo dei dati e software interattivo." Milan, 23-25 October 1990;

"Metodi quantitativi per la gestione della fauna.", Milan, October 1990;

"Tendenze nella depurazione dei reflui urbani in prospettiva di un restringimento dei limiti allo scarico.", 21-25 May 1990;

"Inquinamento e protezione ambientale: fenomenologia e prevenzione." 22-26 October 1990;

Training courses for Ecological Wardens, (Regione Lombardia, Settore Ambiente ed Ecologia, Servizio Volontario di Vigilanza Ecologica):

"Corso di formazione delle guardie ecologiche volontarie;"

"Aree protette e guardia ecologica;"

"Teoria e prassi dell'educazione ambientale;"

"Rilevamento gambero e anfibi."

The author also participated in the Congress "Fiera delle Utopie Concrete-Fuoco." Città di Castello, September 29-October 7 1990.

Persons consulted

The following persons were consulted:

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Dr. Bernardini-Mosconi, Paola, Professore, Dipartamento di Biologia, Università di Pavia.

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Bonifacio, Mario, Servizio Affari Generali, Settore ecologia, Regione Lombardia.

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Dr. Calistre, Franco, Oservatorio Mercato del lavoro, Regione dell'Umbria.

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Dal Fiume, Giorgio, CGIL, Confederazione Italiana di Lavoro - Bologna.

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Giache, Luciano, Progetto Ambiente comme Alfabeto, Provincia di Perugia.

Grassi, Franco, Ufficio di Vigilanza Ecologica, Settore Ecologia, Regione Lombardia.

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Longoni, Ida, Ufficio Relazioni Esterne, Settore Ecologia, Regione Lombardia.

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Dr. Savilli, Directore Laboratorio di Tosicologia Ambientale, Istituto di Recerche Farcologiche Mario Negri.

Dr. Serafini, Assoziazione Industriale di Perugia.

Dr. Setti, Fausta, Professor of Ecology, Department of Biology, University of Milan.

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The author consulted fifteen students of "Corso di Formazione Professionale "Tecnici Ecologico Ambientali. Conzorzio Protecno - Centro Nazionale per la Formazione Professionale sulle Nuove Tecnologie di Progettazione - Regione dell'Umbria.

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